Simulated Transverse Distribution of Polarization Properties for Parsec-Scale Jets in Active Galactic Nuclei

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Aim. ***Modeling transverse properties of linear polarization in AGN jets and searching magnetic field configurations and outflow characteristics to agree with VLBI observational data.***

We considered two types of **magnetic field configurations:**

1) helical field characterized by a pitch angle ψ. For ψ=0°, the magnetic field is poloidal. For ψ=90°, the magnetic field is toroidal.
2) The "spine-sheath" structure with the toroidal field in the spine and the poloidal one in the sheath. We denoted a distance from a jet axis where the transition from the spine to sheath occurs as R_j. We considered the cases when the sheath speed is equal and lower than that of the spine.

We used the **helical jet model** with a non-radial motion of jet components. Parameters of this model are shown in Fig. 1.

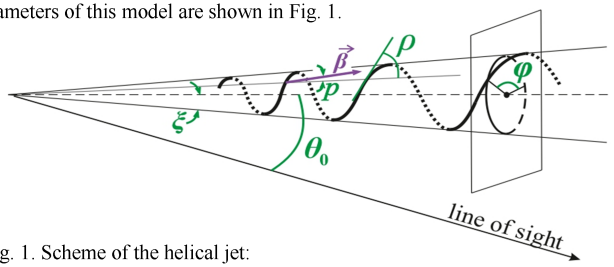


Fig. 1. Scheme of the helical jet:
$\boldsymbol{\xi}$ is the half opening angle of the jet,
$\boldsymbol{\theta_0}$ is the angle between the cone axis and the line of sight,
$\boldsymbol{p}$ is the motion direction angle to the cone generatrix,
$\boldsymbol{\beta}$ is the jet component speed,
$\boldsymbol{\rho}$ is the angle of a tangent to the jet component axis to the cone generatrix,
$\boldsymbol{\varphi}$ is the azimuth angle characterizing a component location on the cone surface relatively to the observer.

The jet model fully describes the set of the observed jet properties, e.g., curved trajectory and changes in a position angle of jet features. Figure 2 illustrates the main differences of our model from the widely used assumption about a jet.

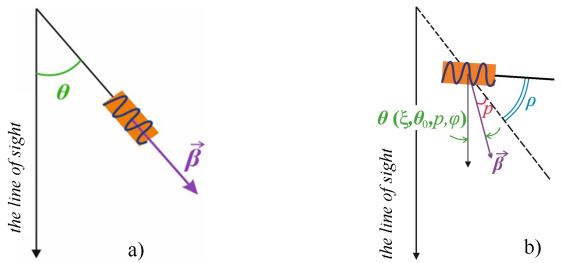


Fig. 2. a) Widely used jet conception. The velocity vector of the straight jet coincides with the jet axis: the angle θ is constant. b) The jet geometry used in this work. The figure shows one component of the helical jet, the axis of which is marked with a bold line. The dashed line shows the radial direction. The line of sight, axis, and velocity vector of the component do not lie in the same plane. In both figures, the spiral schematically shows the spatial orientation of the magnetic field in the jet. element.

We perform calculation using equations for Stokes parameters in Lyutikov, Pariev & Gabuzda 2005. The simulated data points we divided into three intervals according Doppler factor of the considered jet component: red color – high values, green – moderate values, blue – small values of Doppler factor.

Fig. 3. Obtained results for spine-sheath configuration with parameters: R_j=0.33, θ_0=10°, ρ=6°, p=2°. Transverse distributions correspond to the stacked observed data for 0836+710 (Pushkarev et al., in prep.).

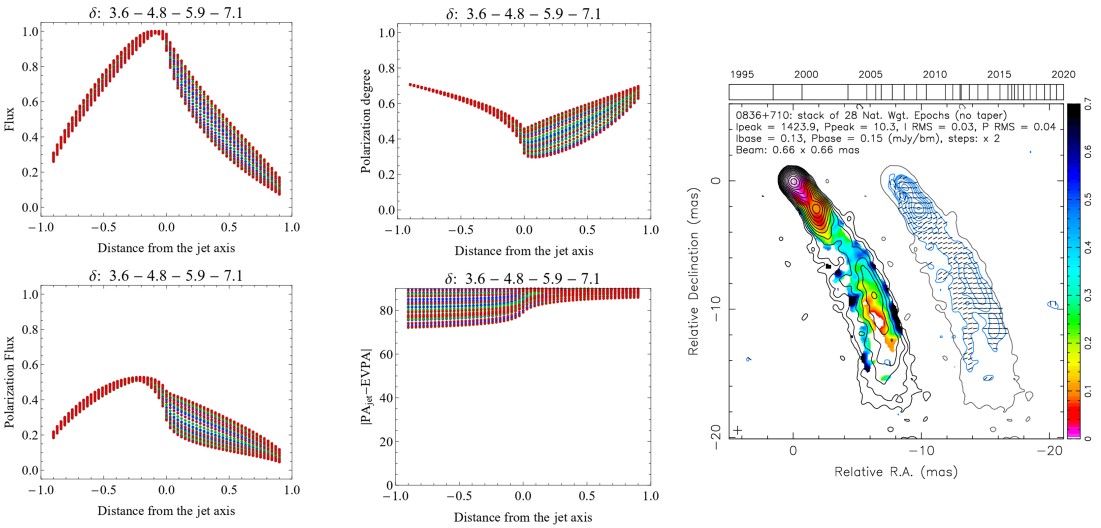
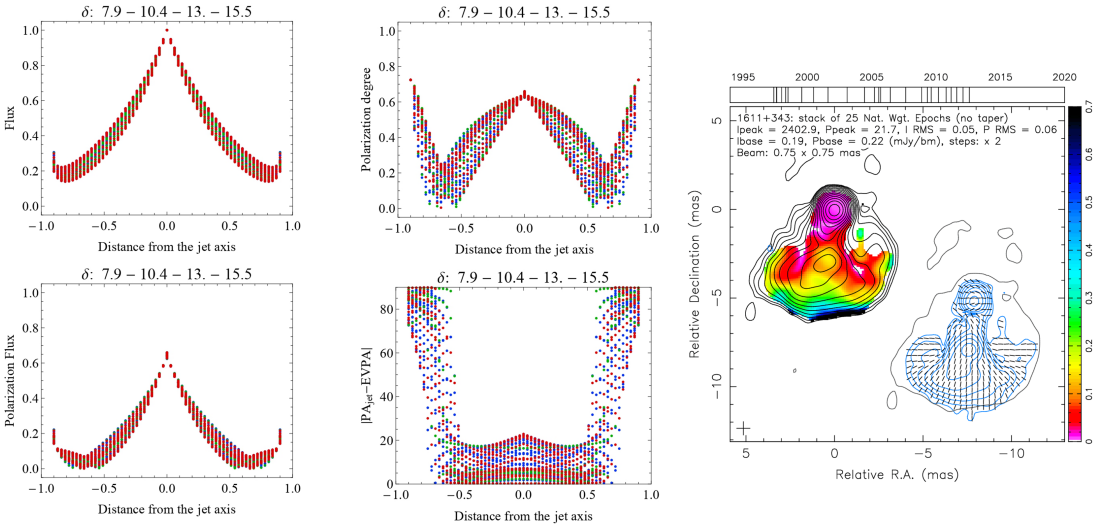


Fig. 4. Obtained results for spine-sheath configuration with parameters: R_j=0.9, θ_0=2°, ρ=25°, p=5°. Transverse distributions correspond to the stacked observed data for 1611+343 (Pushkarev et al., in prep.).



The spine-sheath configuration of the jet magnetic field reproduces different observed properties of polarization, while the helical magnetic field can be responsible for asymmetry in transverse distributions.

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